FINAL

Vendor doc. No.: MTI-U-AXEA005-201
Total Page: 9 Sheets (inc. cover)

Document Title: Data Sheet

Pequiven Petroquímica de Venezuela, S.A.	**1,800 MTPD AMMONIA / 2,200 MTPD UREA PLANT PETROQUIMICA DE VENEZUELA, S.A.MORON PETROCHEMICAL COMPLEX**
TECNO FRONTIER CO., LTD. (T & F) CHIBA, Japan	
T&F Work No.:	BA-0821
REQ No:	AXEA005
ITEM No:	U-EA601, U-EA602, U-EA603, U-EA604
AWBS:	U520
Document No.:	MTI-U-AXEA005-201

Rev.	Date	Description	Drawn by	Design by	Checked by	Approved by
3	Aug. 8, 2008	Rev. as owner Comment	M.S.Kang	T.H.Kim	S.J.Lee	K.D.Lee
2	Jun. 4, 2008	Rev. as owner Comment	M.S.Kang	T.H.Kim	S.J.Lee	K.D.Lee
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0	Mar. 6, 2008	For approval	M.S.Kang	T.H.Kim	S.J.Lee	K.D.Lee

Vendor Name: Power Hx Tech Co., Ltd.

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**			T&F Work No	**BA-0821**	
Client	**Petroquimica de Venezuela S.A.**			Doc. No.	**MTI-U-AXEA005-201 (1/8)**	
Contractor	**Tecno Frontier Co., Ltd. (T & F)**			Date	**2008. 8. 8.**	
Code/Standard	**ASME**			Revision	3	
Service of Unit	**Heater for Spouting Air (Process Cond.)**			Item No.	**U-EA601**	
Type	**High Finned**	Tube Installation	Horizontal	No. of Units	**1**	set(s)
Surface/Unit, Eff.	1,683.9 m^2	Shell Fluid Flow	Horizontal			

PERFORMANCE of ONE UNIT

Fluid Allocation		**Shell Side**		**Tube Side**	
Fluid Name		**Air**		**Process Cond.**	
		Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total	kg/h	**124,494**		**44,107**	
Vapor		124,494	124,494	0	0
Liquid		0	0	44,107	44,107
Condensate			0		0
Temperature	℃	37.8	105.0	147.0	99.0
Density	kg/m^3	1.17	0.96	919	959
Viscosity	Cp	0.019	0.022	0.19	0.29
Molecular Weight		28.6		18.015	
Specific Heat	kcal/kg.℃	0.25	0.25	1.03	1.01
Thermal Conductivity	kcal/m.h.℃	0.023	0.027	0.59	0.58
Latent Heat	kcal/kg	***		***	
Inlet Pressure		490 mmH2O		7.5 kg/cm2.g	
Velocity, i / m / o	m/sec	5.92	6.58 / 7.23	0.94	0.92 / 0.90
Pressure Drop, Allow. / Cal'd		**20** / 16 mmH2O		**0.3** / 0.2 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**2,100,000** kcal/h	MTD	51.00	℃	H. T. Rate, Clean	26.51	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	24.50 $kcal/m^2.h.℃$	H. T. Area, Req.	1,680.7	m2	Cleanliness Factor	92.4	%
H. T. Rate, Service	24.45 kcal/m.h.℃	H. T. Area, Act.	1,683.9	m2	H. T. Area Margin	0.2	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**700** mmH2O		**10** kg/cm2.g		Please refer to the drawing " General Assembly "
Test Press.	- N/A -		13 kg/cm2.g		
Design Temp. ℃	**160**		**175**		
Corrosion Allow mm	**3**		**0**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	
Material	SS 400	SS 400	**A 312 TP304 E**	**A 312 TP304 E**	
Q'ty	1	1	1	1	
Size	1400x1400	***	6"	6"	
Rating	***	***	150 lb	150 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 249 TP304	276	25.4 Avg.	2.77	3,400	* Effective
Fin	Wrapped-on 'LL'	Aluminium		57.2	0.45	Height 15.9	FPI 11
Header	Pipe	A 312 TP304 E	2	168	11	**3,500**	Sch. Sch.80
	Tube Plate	- N/A -	- N/A -		- N/A -		
Tube Bundle	No. of Tubes / Row 46		No. of Rows 6		No. of Tube Passes 6		
	Support Plate :	SS 400	3		20		
	Pitch	Staggered	Trans.	65	Long.	69	*2)
Shell		SS 400			6		
Transition Duct		SS 400			6		

Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos
Accessories	Safety Valve	- N/A -	Expansion Joint	by Others
	Insulation	by Others	Ladder	by Others
Weight	Empty **5,795**	Oper. **6,480**	Filled with Water **6,515**	kg

Remarks

*1) Shell Side Press. Drop : Tube Bundle 8.7 Inlet Duct 7.3 Outlet Duct 0.0 mmH2O

*2) Longitudinal pitch has been increased so that mean radius of U-tube bend meets 1.5 times the tube outside diameter.

*3)

*4)

*5)

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**			T&F Work No	**BA-0821**
Client	**Petroquimica de Venezuela S.A.**			Doc. No.	**MTI-U-AXEA005-201 (2/8)**
Contractor	**Tecno Frontier Co., Ltd. (T & F)**			Date	**2008. 6. 4.**
Code/Standard	**ASME**			Revision	3
Service of Unit	**Heater for Spouting Air (Steam)**	Cond.	**Normal Condition**	Item No.	**U-EA601**
Type	**High Finned**	Tube Installation	Vertical	No. of Units	**1** set(s)
Surface/Unit, Eff.	947.4 m^2	Shell Fluid Flow	Horizontal		

PERFORMANCE of ONE UNIT

Fluid Allocation		Shell Side		Tube Side	
Fluid Name		Air		Steam	
		Inlet	Outlet	Inlet	Outlet
Fluid Quantity, Total	kg/h	**124,494**		**1,550**	
Vapor		124,494	124,494	1,550	0
Liquid		0	0	0	1,550
Condensate			0		0
Temperature	℃	105.0	130.0	151	151
Density	kg/m^3	0.96	0.90	2.64	915.50
Viscosity	Cp	0.022	0.023	0.014	0.179
Molecular Weight		28.6		18.015	
Specific Heat	kcal/kg.℃	0.25	0.25	0.555	1.030
Thermal Conductivity	kcal/m.h.℃	0.027	0.029	0.026	0.590
Latent Heat	kcal/kg	***		503.7	
Inlet Pressure		490 mmH2O		4 kg/cm2.g	
Velocity, i / m / o	m/sec	6.46	6.68 / 6.90	2.86	1.44 / 0.01
Pressure Drop, Allow. / Cal'd		**20** / 18 mmH2O		**0.5** / 0.01 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**781,000** kcal/h	MTD	32.26	℃	H. T. Rate, Clean	37.93	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	35.07 $kcal/m^2.h.℃$	H. T. Area, Req.	690.4	m2	Cleanliness Factor	92.4	%
H. T. Rate, Service	25.55 kcal/m.h.℃	H. T. Area, Act.	947.4	m2	H. T. Area Margin	37.2	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		Tube Side		SKETCH
Design Pres.	**700** mmH2O		**8** kg/cm2.g		Please refer to the drawing " General Assembly "
Test Press.	- N/A -		10.4 kg/cm2.g		
Design Temp. ℃	**160**		**200**		
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	1	1	1	1	
Size	***	1700x1700	6"	6"	
Rating	***	***	150 lb	150 lb	

	Type	Material	Q'ty	OD	Thick	Length	
Tube	High Finned	A 214	330	19.05 Avg.	2.11	3,174	* Effective
Fin	Wrapped-on 'LL'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	6	168	11	**3,656**	Sch. Sch.80
	Tube Plate	A 516-70	6		20		
Tube Bundle	No. of Tubes / Row 55		No. of Rows 6		No. of Tube Passes 1		
	Support Plate :	SS 400	3		20		
	Pitch	Staggered	Trans. 57		Long. 45		
Shell		SS 400			6		
Transition Duct		SS 400			6		

Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos
Accessories	Safety Valve	- N/A -	Expansion Joint	by Others
	Insulation	by Others	Ladder	by Others
Weight	Empty	**5,590**	Oper. **6,040**	Filled with Water **6,390** kg

Remarks

***1) Shell Side Press. Drop :** Tube Bundle 11.6 Inlet Duct 0.0 Outlet Duct 6.4 mmH2O

***2)**

***3)**

***4)**

***5)**

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**		T&F Work No	**BA-0821**
Client	**Petroquimica de Venezuela S.A.**		Doc. No.	**MTI-U-AXEA005-201 (3/8)**
Contractor	**Tecno Frontier Co., Ltd. (T & F)**		Date	**2008. 6. 4.**
Code/Standard	**ASME**		Revision	3
Service of Unit	**Heater for Spouting Air (Steam)**	Cond. **Min. Amb. Temp. Cond.**	Item No.	**U-EA601**
Type	**High Finned**	Tube Installation: Vertical	No. of Units	**1** set(s)
Surface/Unit, Eff.	947.4 m^2	Shell Fluid Flow: Horizontal		

PERFORMANCE of ONE UNIT

Fluid Allocation		**Shell Side**		**Tube Side**	
Fluid Name		**Air**		**Steam**	
		Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total	kg/h	**124,494**		**2,294**	
Vapor		124,494	124,494	2,294	0
Liquid		0	0	0	2,294
Condensate			0		0
Temperature	℃	93.0	130.0	151	151
Density	kg/m^3	0.99	0.90	2.64	915.50
Viscosity	Cp	0.021	0.023	0.014	0.179
Molecular Weight		28.6		18.015	
Specific Heat	kcal/kg.℃	0.25	0.25	0.555	1.030
Thermal Conductivity	kcal/m.h.℃	0.027	0.029	0.026	0.590
Latent Heat	kcal/kg	***		503.7	
Inlet Pressure		490 mmH2O		4 kg/cm2.g	
Velocity, i / m / o	m/sec	6.25	6.58 / 6.90	4.24	2.13 / 0.01
Pressure Drop, Allow. / Cal'd		**20** / 18 mmH2O		**0.5** / 0.01 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**1,156,100** kcal/h	MTD	36.81 ℃	H. T. Rate, Clean	37.48	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	34.68 $kcal/m^2.h.℃$	H. T. Area, Req.	905.5 m2	Cleanliness Factor	92.5	%
H. T. Rate, Service	33.15 kcal/m.h.℃	H. T. Area, Act.	947.4 m2	H. T. Area Margin	4.6	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**700** mmH2O		**8** kg/cm2.g		Please refer to the drawing " General Assembly "
Test Press.	- N/A -		10.4 kg/cm2.g		
Design Temp. ℃	**160**		**200**		
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	1	1	1	1	
Size	***	1700x1700	6"	6"	
Rating	***	***	150 lb	150 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 214	330	19.05 Avg.	2.11	3,174	* Effective
Fin	Wrapped-on 'LL'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	6	168	11	**3,656**	Sch. Sch.80
	Tube Plate	A 516-70	6		20		
Tube Bundle	No. of Tubes / Row 55		No. of Rows 6		No. of Tube Passes 1		
	Support Plate :	SS 400	3		20		
	Pitch	Staggered	Trans. 57		Long. 45		
Shell		SS 400			6		
Transition Duct		SS 400			6		

Gasket	Shell Side: Non-asbetos	Tube Side: Non-asbetos		
Accessories	Safety Valve: - N/A -	Expansion Joint: by Others		
	Insulation: by Others	Ladder: by Others		
Weight	Empty **5,590**	Oper. **6,040**	Filled with Water **6,390**	kg

Remarks

*1) Shell Side Press. Drop : Tube Bundle 11.5 Inlet Duct 0.0 Outlet Duct 6.5 mmH2O

*2)

*3)

*4)

*5)

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**			T&F Work No	**BA-0821**	
Client	**Petroquimica de Venezuela S.A.**			Doc. No.	**MTI-U-AXEA005-201 (4/8)**	
Contractor	**Tecno Frontier Co., Ltd. (T & F)**			Date	**2008. 6. 4.**	
Code/Standard	**ASME**			Revision	3	
Service of Unit	**No.1 Heater for Fluidizing Air**			Item No.	**U-EA602**	
Type	**High Finned**	Tube Installation	Horizontal	No. of Units	**1**	set(s)
Surface/Unit, Eff.	312.6 m^2	Shell Fluid Flow	Vertical Upward			

PERFORMANCE of ONE UNIT

Fluid Allocation		**Shell Side**		**Tube Side**	
Fluid Name		**Air**		**Steam**	
		Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total	kg/h	**85,445**		**2,300**	
Vapor		85,445	85,445	2,300	0
Liquid		0	0	0	2,300
Condensate			0		0
Temperature	℃	26.0	80.0	151	151
Density	kg/m^3	1.22	1.03	2.64	915.50
Viscosity	Cp	0.018	0.021	0.014	0.179
Molecular Weight		28.6		18.015	
Specific Heat	kcal/kg.℃	0.25	0.25	0.555	1.030
Thermal Conductivity	kcal/m.h.℃	0.022	0.026	0.026	0.590
Latent Heat	kcal/kg	***		503.7	
Inlet Pressure		490 mmH2O		4 kg/cm2.g	
Velocity, i / m / o	m/sec	9.83	10.73 / 11.64	29.22	14.65 / 0.08
Pressure Drop, Allow. / Cal'd		**30** / 28 mmH2O		**0.5** / 0.2 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**1,273,800** kcal/h	MTD	95.84 ℃	H. T. Rate, Clean	47.61	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	43.18 $kcal/m^2.h.℃$	H. T. Area, Req.	307.8 m2	Cleanliness Factor	90.7	%
H. T. Rate, Service	42.52 kcal/m.h.℃	H. T. Area, Act.	312.6 m2	H. T. Area Margin	1.6	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**700** mmH2O		**8** kg/cm2.g		Please refer to the drawing " General Assembly "
Test Press.	- N/A -		10.4 kg/cm2.g		
Design Temp. ℃	**110**		**200**		
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	1	1	1	1	
Size	1700x1000	1700x1000	6"	6"	
Rating	***	***	150 lb	150 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 214	192	19.05 Avg.	2.11	1,800	* Effective
Fin	Wrapped-on 'LL'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	2	168	11	**2,560**	Sch. Sch.80
	Tube Plate	- N/A -	- N/A -		- N/A -		
Tube Bundle	No. of Tubes / Row 48		No. of Rows 4		No. of Tube Passes 4		
	Support Plate :	SS 400	3		12		
	Pitch	Staggered	Trans. 48		Long. 52		
Shell		SS 400			6		
Transition Duct		SS 400			6		
Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos			
Accessories	Safety Valve	- N/A -	Expansion Joint	by Others			
	Insulation	by Others	Ladder	by Others			
Weight	Empty	**2,485**	Oper.	**2,665**	Filled with Water	**2,750**	kg

Remarks

*1) Shell Side Press. Drop : Tube Bundle 17.7 Inlet Duct 4.6 Outlet Duct 5.6 mmH2O

*2)

*3)

*4)

*5)

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**			T&F Work No	**BA-0821**	
Client	**Petroquimica de Venezuela S.A.**			Doc. No.	**MTI-U-AXEA005-201 (5/8)**	
Contractor	**Tecno Frontier Co., Ltd. (T & F)**			Date	**2008. 6. 4.**	
Code/Standard	**ASME**			Revision	3	
Service of Unit	**No.2 Heater for Fluidizing Air**			Item No.	**U-EA603**	
Type	**High Finned**	Tube Installation	Horizontal	No. of Units	**1**	set(s)
Surface/Unit, Eff.	141.1 m^2	Shell Fluid Flow	Vertical			

PERFORMANCE of ONE UNIT

Fluid Allocation		**Shell Side**		**Tube Side**	
Fluid Name		**Air**		**Steam**	
		Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total	kg/h	**158,314**		**946**	
Vapor		158,314	158,314	946	0
Liquid		0	0	0	946
Condensate			0		0
Temperature	℃	26.0	38.0	151	151
Density	kg/m^3	1.22	1.17	2.64	915.50
Viscosity	Cp	0.018	0.019	0.014	0.179
Molecular Weight		28.6		18.015	
Specific Heat	kcal/kg.℃	0.25	0.25	0.555	1.030
Thermal Conductivity	kcal/m.h.℃	0.022	0.023	0.026	0.590
Latent Heat	kcal/kg	***		503.7	
Inlet Pressure		490 mmH2O		4 kg/cm2.g	
Velocity, i / m / o	m/sec	13.26	13.53 / 13.80	9.62	4.82 / 0.03
Pressure Drop, Allow. / Cal'd		**30** / 9 mmH2O		**0.5** / 0.01 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**524,700** kcal/h	MTD	119.26	℃	H. T. Rate, Clean	34.52	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	32.13 $kcal/m^2.h.℃$	H. T. Area, Req.	136.9	m2	Cleanliness Factor	93.1	%
H. T. Rate, Service	31.18 kcal/m.h.℃	H. T. Area, Act.	141.1	m2	H. T. Area Margin	3.1	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**700** mmH2O		**8** kg/cm2.g		Please refer to the drawing " General Assembly "
Test Press.	- N/A -		10.4 kg/cm2.g		
Design Temp. ℃	**70**		**200**		
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	1	1	1	1	
Size	1900x1900	1900x1900	3"	3"	
Rating	***	***	150 lb	150 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 214	60	19.05 Avg.	2.11	2,600	* Effective
Fin	Wrapped-on 'LL'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	2	114	8.56	**2,620**	Sch. Sch.80
	Tube Plate	A 516-70	2		20		
Tube Bundle	No. of Tubes / Row 60		No. of Rows 1		No. of Tube Passes 1		
	Support Plate :	SS 400	1		12		
	Pitch In-line		Trans. 43		Long. ***		
Shell		SS 400			6		
Transition Duct		SS 400			6		
Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos			
Accessories	Safety Valve - N/A -		Expansion Joint	by Others			
	Insulation	by Others	Ladder	by Others			
Weight	Empty **1,875**		Oper. **1,995**		Filled with Water **2,045**		kg

Remarks

***1)** Shell Side Press. Drop : Tube Bundle 4.9 Inlet Duct 2.2 Outlet Duct 1.9 mmH2O

***2)**

***3)**

***4)**

***5)**

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**		T&F Work No	**BA-0821**
Client	**Petroquimica de Venezuela S.A.**		Doc. No.	**MTI-U-AXEA005-201 (6/8)**
Contractor	**Tecno Frontier Co., Ltd. (T & F)**		Date	**2008. 8. 8.**
Code/Standard	**ASME**		Revision	3
Service of Unit	**Chiller for Product Cooler (Liquid NH3)**		Item No.	**U-EA604**
Type	**High Finned**	Tube Installation: Vertical	No. of Units	**1** set(s)
Surface/Unit, Eff.	5,054.1 m^2	Shell Fluid Flow: Horizontal		

PERFORMANCE of ONE UNIT

Fluid Allocation			**Shell Side**		**Tube Side**	
Fluid Name			**Air**		**NH3**	
			Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total		kg/h	124,426		7,516	
Vapor			124,426	122,250	0	7,516
Liquid			0	2,176	7,516	0
Condensate				2,176		0
Temperature		℃	37.8	7.0	2	2
Density	V / L	kg/m^3	1.17	1.30 / 1000	636	3.72
Viscosity	V / L	Cp	0.019	0.018 / 1.43	0.25	0.01
Molecular Weight	(Vapor / Noncondensable)		18 / 29		17	
Specific Heat	V / L	kcal/kg.℃	0.25	0.24 / 1.00	1.11	0.65
Thermal Conductivity	V / L	kcal/m.h.℃	0.023	0.021 / 0.50	0.43	0.019
Latent Heat		kcal/kg	***		299.6	
Inlet Pressure			350 mmH2O		3.7 kg/cm2.g	
Velocity, i / m / o		m/sec	3.75	3.56 / 3.36	0.01	1.12 / 2.23
Pressure Drop, Allow. / Cal'd			**30** / 25 mmH2O		**0.03** / 0.01 kg/cm2	
Fouling Resistance		$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**2,700,000**	kcal/h	MTD	15.20	℃	H. T. Rate, Clean	44.73	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	40.62	$kcal/m^2.h.℃$	H. T. Area, Req.	4,373.5	m2	Cleanliness Factor	90.8	%
H. T. Rate, Service	35.15	kcal/m.h.℃	H. T. Area, Act.	5,054.1	m2	H. T. Area Margin	15.6	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**450** mmH2O		**20** kg/cm2.g **& F.V.**		
Test Press.	- N/A -		26 kg/cm2.g		
Design Temp. ℃	**70**		**-12**	**70**	
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	Please refer to the drawing " General Assembly "
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	1	***	1	1	
Size	2000x2000	***	4"	10"	
Rating	***	***	300 lb	300 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 179	1456	19.05 Avg.	2.11	3,650	* Effective
Fin	Wrapped-on 'L'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	14	219	12.7	**3,470**	Sch. Sch.80
	Tube Plate	A 516-70	14		20		
Tube Bundle	No. of Tubes / Row 52		No. of Rows 28		No. of Tube Passes 1		
	Support Plate :	SS 400	7		12		
	Pitch	Staggered	Trans. 65		Long. 50		
Shell		SS 400			6		
Transition Duct		SS 400			6		
Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos			
Accessories	Safety Valve	- N/A -	Expansion Joint	by Others			
	Insulation	by Others	Ladder	by Others			
Weight	Empty **18,980**		Oper. **20,395**		Filled with Water **21,680**		kg

Remarks

*1) Shell Side Press. Drop : Tube Bundle 22.7 Inlet Duct 2.3 Outlet Duct 0.0 mmH2O

*2) Demister type separator is provided downstream for condensate removal.

*3) Press. Drop of Demister : **5.3** mmH2O -> Total Shell Side Press. Drop : **30.3** mmH2O

*4)

*5)

HMT

HANBAL MASSTECH LIMITED

GIMHAE, KOREA, FAX:82-55-338-1919 TEL:82-55-338-1911

<< DEMISTER DATA SHEET >>

CLIENT	: Petroquimica de Venezuela S.A.	DATE	: Apr. 25. 2008
PROJECT	: 1800 MTPD Ammonia / 2200 MTPD Urea Plant	ITEM No.	: U-EA604
SERVICE	: Demister for Chiller for Product Cooler(Liquid NH3)	DESIGN BY	: K.R.LEE
TYPE	: WIRE MESH	DOC. NO.	: MTI-U-AXEA005-201(7/8)

DESIGN CONDITION		REMARK
NAME	AIR	
FLOW RATE (KG/HR)	124,426	
DENSITY (Kg/M^3)	1.30	
FLOW RATE (M^3/HR)	95,712	
VISCOSITY (cP)	0.018	

REMOVAL PARTS		REMARK
NAME	WATER	
DENSITY (Kg/M^3)	1000	
PARTICLE SIZE (MICRON)	10	

RESULT		REQUIRE
SEPARATION EFFICIENCY (%)	99.3%	
PRESSURE DROP (mmH2O)	5.3	10
ACTUAL VAPOR VELOCITY (M/S)	2.0	
ALLOWABLE VAPOR VELOCITY (M/S)	MAXIMUM	MINIMUM
	3.5	0.7

NOTE :

PAD DIMENSION

PAD TYPE	HB-80	DENSITY (Kg/M^3)	80
VESSEL I.D.		FREE VOLUME (%)	99.0%
PAD OD OR		Eq. STYLE	YORK 931
PAD DIMENSION - W x L (mm)	3828 X 3650	PAD AREA (M^2)	13.97220
SUPPORT RING WIDTH (mm)	50	PAD MATERIAL	304SS
PAD THICKNESS (mm)	150	GRID MATERIAL	304SS

HEAT EXCHANGER SPECIFICATION SHEET

Project	**1,800 MTPD Ammonia / 2,200 MTPD Urea Plant**			T&F Work No	**BA-0821**	
Client	**Petroquimica de Venezuela S.A.**			Doc. No.	**MTI-U-AXEA005-201 (8/8)**	
Contractor	**Tecno Frontier Co., Ltd. (T & F)**			Date	**2008. 6. 4.**	
Code/Standard	**ASME**			Revision	3	
Service of Unit	**Chiller for Product Cooler (Steam)**			Item No.	**U-EA604**	
Type	**High Finned**	Tube Installation	Vertical	No. of Units	**1**	set(s)
Surface/Unit, Eff.	73.3 m^2	Shell Fluid Flow	Horizontal			

PERFORMANCE of ONE UNIT

Fluid Allocation		**Shell Side**		**Tube Side**	
Fluid Name		**Air**		**Steam**	
		Inlet	**Outlet**	**Inlet**	**Outlet**
Fluid Quantity, Total	kg/h	122,250		284	
Vapor		122,250	122,250	284	0
Liquid		0	0	0	284
Condensate			0		0
Temperature	℃	7.0	12.0	133	133
Density	kg/m^3	1.3	1.27	1.64	931.78
Viscosity	Cp	0.018	0.018	0.013	0.206
Molecular Weight	(Vapor / Noncondensable)	18 / 29		18.015	
Specific Heat	kcal/kg.℃	0.24	0.24	0.525	1.020
Thermal Conductivity	kcal/m.h.℃	0.021	0.021	0.024	0.591
Latent Heat	kcal/kg	***		516.9	
Inlet Pressure		350 mmH2O		2 kg/cm2.g	
Velocity, i / m / o	m/sec	5.91	5.98 / 6.06	9.29	4.65 / 0.02
Pressure Drop, Allow. / Cal'd		**10** / 3 mmH2O		**0.5** / 0.01 kg/cm2	
Fouling Resistance	$kcal/m^2.h.℃$	**0.0002**		**0.0001**	

Heat Duty	**176,400** kcal/h	MTD	123.73 ℃	H. T. Rate, Clean	20.74	$kcal/m^2.h.℃$
H. T. Rate, Cal'd	19.86 $kcal/m^2.h.℃$	H. T. Area, Req.	71.8 m2	Cleanliness Factor	95.7	%
H. T. Rate, Service	19.46 kcal/m.h.℃	H. T. Area, Act.	**73.3** m2	H. T. Area Margin	2.1	%

DESIGN, MATERIALS and CONSTRUCTION of ONE UNIT

	Shell Side		**Tube Side**		**SKETCH**
Design Pres.	**450** mmH2O		**5** kg/cm2.g		
Test Press.	- N/A -		6.5 kg/cm2.g		
Design Temp. ℃	**70**		**200**		
Corrosion Allow mm	**3**		**3**		
Nozzle	**Inlet**	**Outlet**	**Inlet**	**Outlet**	Please refer to the drawing " General Assembly "
Material	SS 400	SS 400	A 106-B	A 106-B	
Q'ty	***	1	1	1	
Size	***	1600x1600	2"	2"	
Rating	***	***	150 lb	150 lb	

	Type	**Material**	**Q'ty**	**OD**	**Thick**	**Length**	
Tube	High Finned	A 214	30	19.05 Avg.	2.11	2,700	* Effective
Fin	Wrapped-on 'LL'	Aluminium		41.1	0.45	Height 11	FPI 11
Header	Pipe	A 106-B	2	141	9.53	**2,500**	Sch. Sch.80
	Tube Plate	**A 516-70**	**2**		**20**		
Tube Bundle	No. of Tubes / Row 30		No. of Rows 1		No. of Tube Passes 1		
	Support Plate :	SS 400	1		12		
	Pitch	In-line	Trans.	80	Long.	***	
Shell		SS 400			6		
Transition Duct		SS 400			6		
Gasket	Shell Side	Non-asbetos	Tube Side	Non-asbetos			
Accessories	Safety Valve	- N/A -	Expansion Joint	by Others			
	Insulation	by Others	Ladder	by Others			
Weight	Empty	**2,520**	Oper.	**2,550**	Filled with Water	**2,590**	kg

Remarks

*1) Shell Side Press. Drop : Tube Bundle 0.5 Inlet Duct 0.0 Outlet Duct 2.5 mmH2O

*2)

*3)

*4)

*5)